US006016311A

United States Patent [19]

Gilbert et al.

[11] Patent Number: 6,016,311

[45] Date of Patent: Jan. 18, 2000

[54] **ADAPTIVE TIME DIVISION DUPLEXING METHOD AND APPARATUS FOR DYNAMIC BANDWIDTH ALLOCATION WITHIN A WIRELESS COMMUNICATION SYSTEM**

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[73] Assignee: **Ensemble Communications, Inc.**, San Diego, Calif.

[21] Appl. No.: **08/974,376**

[22] Filed: **Nov. 19, 1997**

[51] **Int. Cl.**[7] **H04Q 7/20**

[52] **U.S. Cl.** **370/280**; 370/329; 370/468; 455/450; 455/452

[58] **Field of Search** 370/280, 329, 370/336–338, 345–349, 468; 455/450–453

[56] **References Cited**

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H.C. Papadopoulos et al., "Reduction of Mixed Co–channel Interference in Microcellular STDD Systems", Vehicular Technology Conference, 1995 IEEE 45th, vol. 2, pp. 759–763.

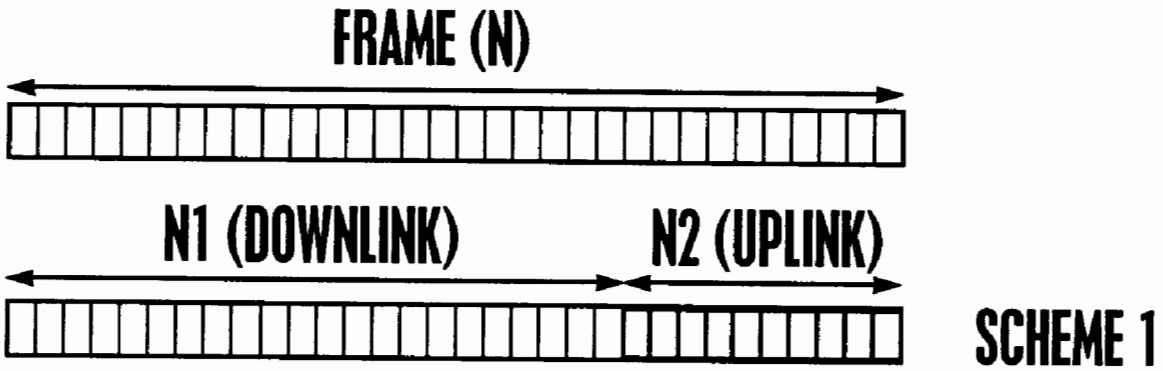
Primary Examiner—Melvin Marcelo

Attorney, Agent, or Firm—Jaquez & Associates; Martin J. Jaquez

[57] **ABSTRACT**

An adaptive time division duplexing (ATDD) method and apparatus for duplexing transmissions on a communication link in wireless communication systems. Communication link efficiency is enhanced by dynamically adapting to the uplink and downlink bandwidth requirements of the communication channels. Time slots are flexibly and dynamically allocated for uplink or downlink transmissions depending upon the bandwidth needs of a channel. Communication link bandwidth requirements are continuously monitored using sets of pre-determined bandwidth requirement parameters. Communication channels are configured to have either symmetric or asymmetric uplink/downlink bandwidths depending upon the needs of the channel. Channel bandwidth asymmetry can be configured alternatively in favor of the uplink transmissions (i.e., more time slots are allocated for uplink transmissions than for downlink transmissions) or in favor of the downlink transmissions (i.e., more time slots are allocated for downlink transmissions than for uplink transmissions). A myriad of time slot allocation schemes are possible. One simplified time slot allocation scheme uses a "frame-based" approach. A preferred channel bandwidth analysis technique is disclosed which monitors and updates bandwidth requirement parameters associated with communication sessions, base stations and cell cluster controllers. In accordance with this technique, a communication session is preferably assigned both an "initial" and an "actual" set of bandwidth parameters.

45 Claims, 6 Drawing Sheets



SCHEME 1

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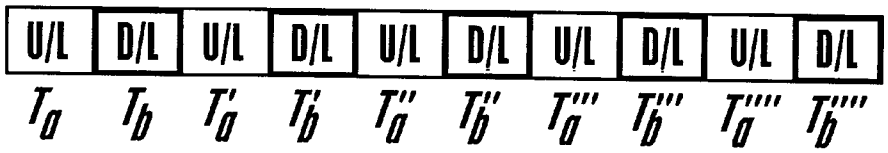

Fig. 1 (PRIOR ART)

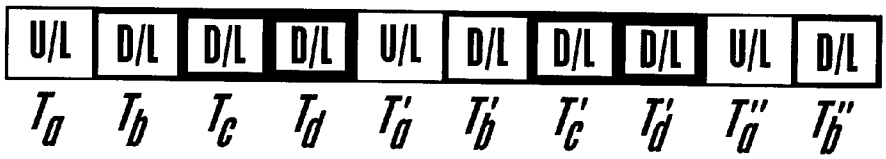

Fig. 2

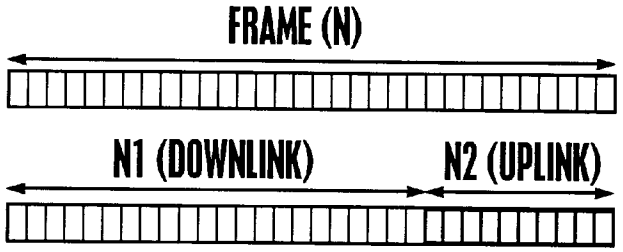

Fig. 3A

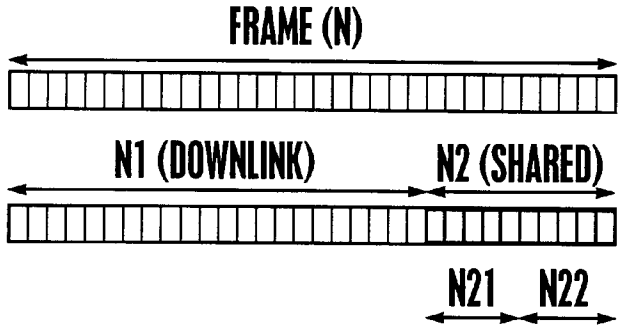

Fig. 3B

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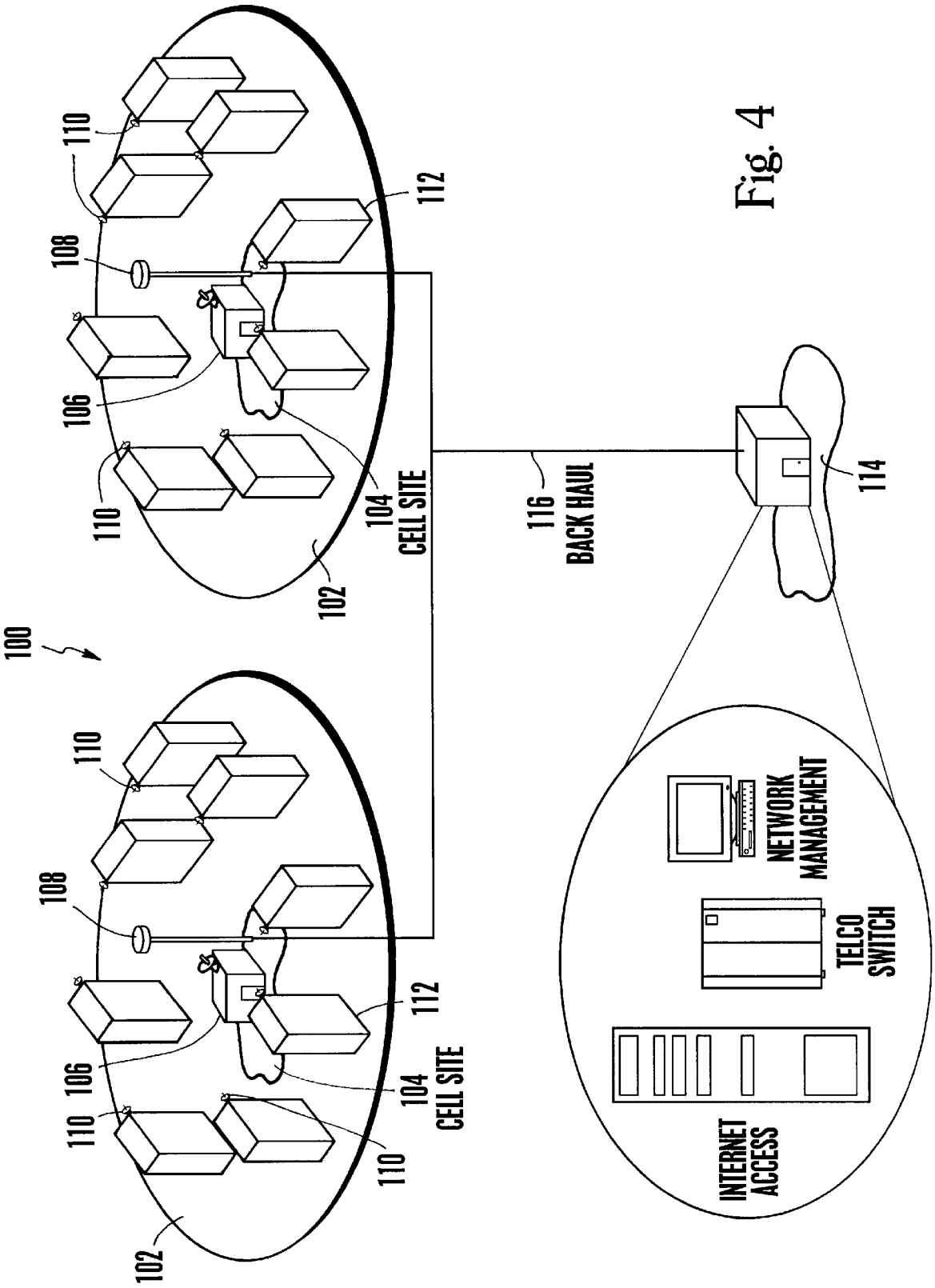

Fig. 4

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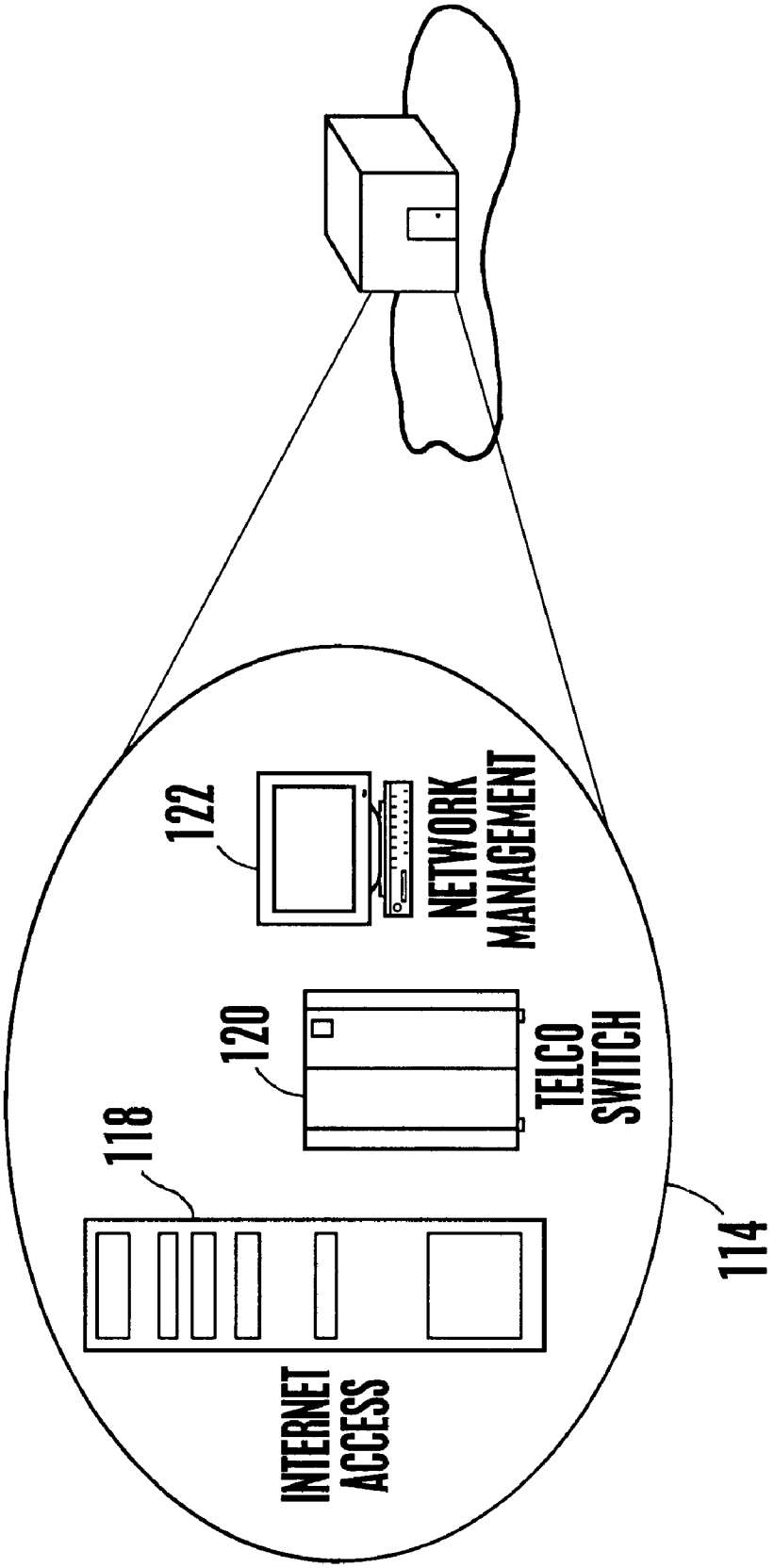

Fig. 5

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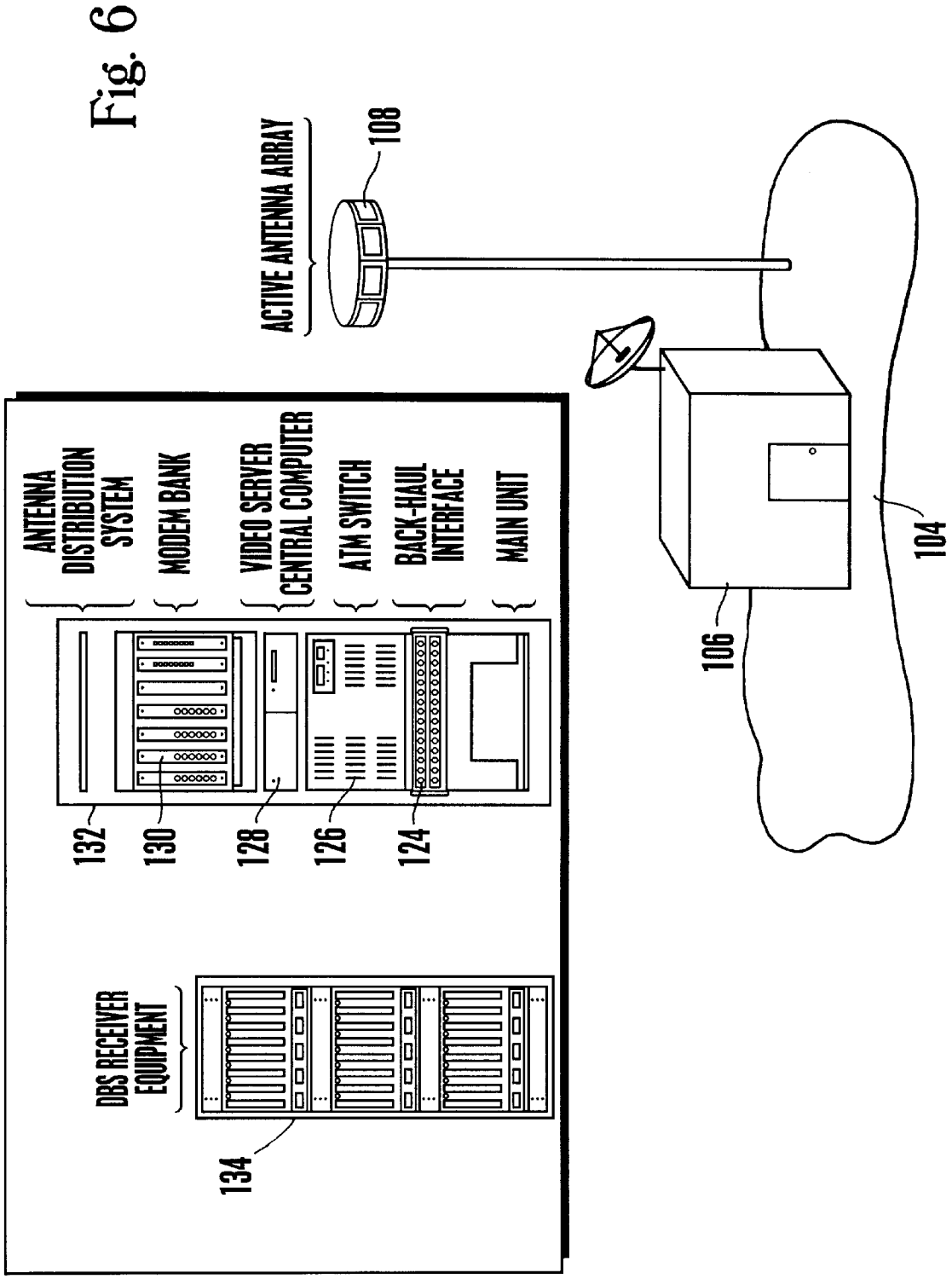
Fig. 6



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